

BEFORE THE PUBLIC UTILITIES COMMISSION OF THE STATE OF CALIFORNIA

Order Instituting Rulemaking Regarding Policies,
Procedures and Rules for the California Solar Initiative,
the Self-Generation Incentive Program and Other
Distributed Generation Issues

Rulemaking 06-03-004
Filed March 21, 2006

COMMENTS BY SUN LIGHT & POWER COMPANY REGARDING THE CPUC ENERGY DIVISION STAFF PROPOSAL FOR CALIFORNIA SOLAR INITIATIVE DESIGN AND ADMINISTRATION 2007-2016

Pursuant to Administrative Law Judge's Ruling Requesting Comment on Staff Proposal for Performance Based Incentives and Other Elements of the California Solar Initiative, issued April 25, 2006 and subsequent email ruling extending the deadline for comments to May 16, 2006, Sun Light & Power Company respectfully submits these comments in response to the CPUC Energy Division Staff Proposal for California Solar Initiative Design and Administration 2007-20016 ("the Staff Proposal") dated April 24, 2006.

As a member of CalSEIA, Sun Light & Power Company has been participating in the "Joint Parties" filing by CalSEIA, PV Now and Vote Solar. This document is intended to be supportive and additive to the Joint Parties filing.

Sun Light & Power Company is a 30 year-old solar integrator located in Berkeley CA. We have been participating in both the CEC Emerging Renewables Buydown Program (ERBP) and the SGIP since their respective inceptions. We are primarily a local business, and our business is 100% solar. We are long-time members of CalSEIA, and our President and author of this document, Gary Gerber, is chairman of the Policy Committee of CalSEIA. As such, we are quite familiar with common industry views, practices and positions.

Introduction

On March 16, 2006, the California Public Utility Commission issued an Order implementing the California Solar Initiative, an unprecedented 11-year effort to promote large-scale adoption of solar energy systems in the state of California. Since that time, the CPUC staff has created a timetable

and policy recommendations to implement this program. Our purpose in this filing is to bring to the process some of the key knowledge and experience of the solar industry, in order to inform the CPUC as to what policies and practices the industry feels will be successful as this program advances. In this document we will discuss both general concepts and specific guidelines which we feel are critically important to the success of this program. We will refer often to a survey of CalSEIA members which inform and support the views of this document.

In order to meet the aggressive and ambitious solar adoption goals of the CSI, the industry must be considered a key partner with the CPUC. The CPUC will provide the funding, guidelines and supervision of the program; the solar industry will provide the products, sales and installation of the systems. Both parties are absolutely essential and must do their jobs exceptionally well for this program to be successful.

We have identified five key points which we feel should inform all aspects of the design and implementation of a successful CSI. They are:

- 1. In order for the program to meet its goals there must be a robust and growing pool of solar integrators, suppliers and manufacturers, who are motivated to aggressively market PV to the public and to business.**
- 2. In order for the program to succeed the incentives must be set at a level and operate in a manner which will motivate buyers.**
- 3. Program goals should reflect the realistic value of the power produced, and expected future improvements in both solar technology and energy efficiency should be anticipated in program funding levels.**
- 4. Module costs are the main driver in the cost of a PV system. While the California market is large, California is still a small player in a world market, and we must be realistic about the potential for module cost reductions.**
- 5. While simplicity is a desired outcome in the administration of the program, the market**

realities are actually quite complex and require sophisticated models and close supervision to prevent undesirable and possibly disabling disruptions in the program.

Discussion

1. In order for the program to meet its goals there must be a robust and growing pool of solar integrators, suppliers and manufacturers, who are motivated to aggressively market PV to the public and to business. There are not at this time enough integrators to sell and install the number of modules currently proposed for 2007 and beyond. This program must be designed both to attract an increasing number of installers to operate in this state and to convince the existing integrators to greatly expand their businesses here. This means that the program needs to compete with other programs throughout the world which are attracting both PV products and businesses away from this state.

A healthy and growing pool of solar equipment manufacturers, distributors and integrators is a crucial ingredient in assuring the success of this program. While some of California's solar business owners are altruistic and will try to stay in the solar business regardless of the business climate, California cannot rely on altruistic businesses alone to grow this industry to the levels it must attain to achieve the stated goals. If companies find that they cannot make a reasonable profit in the business of selling solar systems in California, they will do one of the following:

1. Get out of the solar business (or not get in the business to begin with);
2. Move or expand operations to another state where they can make money; or
3. Cut corners and economize, or try to "game" the system.

None of the above options is going to promote the success of the CSI program. To meet its goals, the CSI is going to require an expanding number of companies actively selling and installing PV systems, and those companies currently installing systems will need to expand their businesses as well.

As of today there are 310 registered PV companies listed on the CEC website. Of that number, 83 indicate that they do not install systems. Another 15 are duplicates, and another one only does wind generators. That leaves 211 companies that claim to install solar systems in the state. Not

all of them are seriously involved in the industry. For example, of the total of 343 entities applying for at least one rebate in 2005, over half applied for 3 rebates or fewer, and over 100 of them only applied for a single rebate, indicating that they are probably self-installations. So it would be optimistic to say that there are close to 200 companies actively installing PV systems in California today. Of that number, only one company installed more than 1 MW under the CEC ERBP. Data is not available from the SGIP to evaluate how many SGIP participants have installed over 1 MW/year, but we know that it is no more than a dozen.

The following table, using data from the Staff Proposal, illustrates the need for installation capacity to meet proposed goals:

Figure 1: Staff Proposal for CSI Incentive Levels and MW Installed

Proposed CSI Goals for Installations
(in millions of dollars)

Year	Total Incentive \$	Proposed Incentive level (drops 10%/yr)	Resulting MW Required
2006	255	\$2.50	102
2007	298	\$1.50	199
2008	298	\$1.35	221
2009	298	\$1.22	245
2010	234	\$1.09	214
2011	234	\$0.98	238
2012	234	\$0.89	264
2013	149	\$0.80	187
2014	149	\$0.72	208
2015	149	\$0.65	231
2016	85	\$0.58	146
Totals:	2,383		2,254

Although the numbers are not explicitly stated in the Staff Proposal, the table above calculates that under the proposed program the 2006 goal for installed PV capacity is about 102 MW and in 2007 it grows to 200 MW.

In 2005, the entire pool of installed PV, including both CEC and SGIP was 40.5 MW (see CEC website, Grid-Connected_PV.xls). This leaves us with the need for more than a 2-fold increase in installations for 2006 and a 5-fold increase by 2007 compared with 2005.

Previous years of installation data (see the same report, with tabulated values in Fig. 2 below) show that the actual rate of increase in installation rates has been steadily dropping, to the point that between 2004 and 2005 the number of installations increased by only 22% (from 33,120 MW to 40,497 MW). We also analyzed the first quarter of 2006; data shows that rates of installation have increased by about 40% compared to Q1 2005 (see attached spreadsheet prepared by Ryan Wiser of LBL based on CEC data), which is hopeful, but quarterly data is typically quite variable and cannot be relied upon for accurate overall trend analysis. However, it is notable that within Q1 2006 there is clearly a trend away from residential (<6 KW) systems and towards commercial (>6 KW) systems, with 12% and 68% growth rates respectively.

Figure 2: Comparison of Annual KW Installed under ERBP and CSI Combined

Year	2000	2001	2002	2003	2004	2005
Total KW Installed- CEC Plus SGIP:	726	4,034	9,990	22,201	33,120	40,497
Increase:		556%	248%	222%	149%	122%

The unavoidable conclusion is that if there is not a significant increase in the number of PV installers in the state, within 2 years the average capacity of all 200 installers will need to increase to approximately 1 MW per year. At the moment, there are only a handful of installers with a 1 MW installation capacity. Based on my own experience, it takes .03 to .04 field labor hours to install a watt of PV, so each company installing 1 MW will need enough field employees to provide approximately 30,000 to 40,000 hours per year, which equates to 15 to 20 field employees per company by 2007, and a total of at least 3,000 qualified field installers. Few of the companies presently installing PV in the state have 20 or more field employees, much less the office staff to support that number of employees.

Module supplies will also have to increase in a similar way. With Germany, Japan, Spain,

Portugal, and Italy creating their own strong rebate and incentive programs, and with well over half of the states providing some sort of rebate or tax credit (see Appendix, Table A), most manufacturers have been unwilling to significantly increase their module allocations to California. The California industry is constantly told that as long as other locations in the world can afford to pay more for modules, the California supply will be severely limited.

CalSEIA performed a survey to gauge the industry reaction to the Staff Proposal and to gather data on costs and customer price sensitivity (see attached pdf document titled CAL SEIA Membership Poll Final Document 5-13-061). While the survey is not rigorously scientific, respondents included many of the key solar integrators in the state and we feel does represent a good measure of the industry as a whole. Pertinent to the point at hand are questions 4 through 7 of the survey. Question 4 addresses industry response to the anticipated drop in residential incentive levels from \$2.80 to \$2.25 and the commercial drop from \$2.80 to \$1.50. There was no indication from any of the integrators that they would be able to grow their businesses at these lower incentive levels, and several anticipated reductions in size, and would possibly explore the option of moving out of the state. In contrast, response to question 7 indicated that they would anticipate a robust average 33% growth rate under the current regime of higher rebates (\$2.80/W) and smaller incentive reductions.

The following table calculates the growth in MW installation capacity which would occur at various annual growth rates, assuming a starting capacity of 40.5 MW (per the 2005 total installed capacity):

Figure 3: Calculated Increase in MW Installation capacity at various rates of growth

Increase in MW Installation capacity at various rates of growth												
Assuming a starting MW capacity of 40.5 MW												
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	
Year	1	2	3	4	5	6	7	8	9	10	11	Total
15%	47	54	62	71	81	94	108	124	142	164	188	1,134
20%	49	58	70	84	101	121	145	174	209	251	301	1,563
25%	51	63	79	99	124	154	193	241	302	377	471	2,155
30%	53	68	89	116	150	195	254	330	429	558	726	2,970
35%	55	74	100	135	182	245	331	447	603	814	1099	4,084
40%	57	79	111	156	218	305	427	598	837	1171	1640	5,599

Based on this table, it appears that a sustained growth rate of about 28% should be sufficient to provide the desired 2,600 MW of total installed PV by 2016.

From question 1 of the CalSEIA survey it can also be calculated that the average gross margin in the residential PV installation business is about 23%. That is, taking the average selling price for a 4 KW PV system (\$9.75/CECW) and subtracting the total direct costs (\$7.47), there is a gross margin of \$2.28. This is 23.3% of the \$9.75 selling price. This is a very reasonable gross margin, but by no means overly high. In the construction industry, according to Robert Morris Associates' 2005/2006 Statement Studies, the gross margin percentage for contractors performing \$1 - \$10 million of volume ranges from 17% on the low end to 30% on the high end, putting the solar industry squarely in the middle. This tells us that unless module prices drop, it is not going to be feasible for the industry to reduce prices significantly without taking all profit out of the business. Answers to question 3 confirm that the industry concurs on this issue; most respondents indicated that there was little if any room in their profit margins to reduce prices.

In conclusion, we feel that the installation growth rates envisioned in the Staff Proposal are not achievable, especially given the severe reduction in incentive levels in the commercial sector, which is currently the fastest growing sector. However, by maintaining incentives at a high enough level that the industry can be profitable, the industry should be able to respond with an estimated annual growth rate of 33% and the CSI goals should be attainable.

2. In order for the program to succeed the incentives must be set at a level and operate in a manner which will motivate buyers. The financial conditions conducive to motivating PV purchases are complex and sensitive to many market conditions. If the overall financial picture falls short of what is desired by the buyers, sales will fall off precipitously and the program will fail to reach its stated goals.

Staff has indicated that the rate of SGIP incentive applications received so far in 2006 indicate a very strong and growing PV market (perhaps to the point of "overheated"). As a result, they recommend significant rebate reductions, under the assumption that such a strong market will be able to absorb these reductions and continue to grow. It is our contention that neither of these assumptions is correct; the market is reasonably strong, but not overheated, and it cannot absorb

a large incentive reduction, especially if the goal is 30% annual growth.

Staff has also placed much emphasis on the effect of the federal tax credit in “heating up” the market, especially the commercial market, and has put forward a plan to effectively negate roughly 50% of the federal tax credit for commercial customers.

If one looks closely at all aspects of the residential and commercial PV markets one will see several problems with the staff position, which seem to stem from a lack of understanding of the market.

Market Status

Faced with a large influx of applications for several years and an apparent overenrollment of funds, the SGIP staff has logically concluded that the PV market is too strong and needs to be cooled off. It is our contention that this is actually not the case, but rather a false message due to several factors.

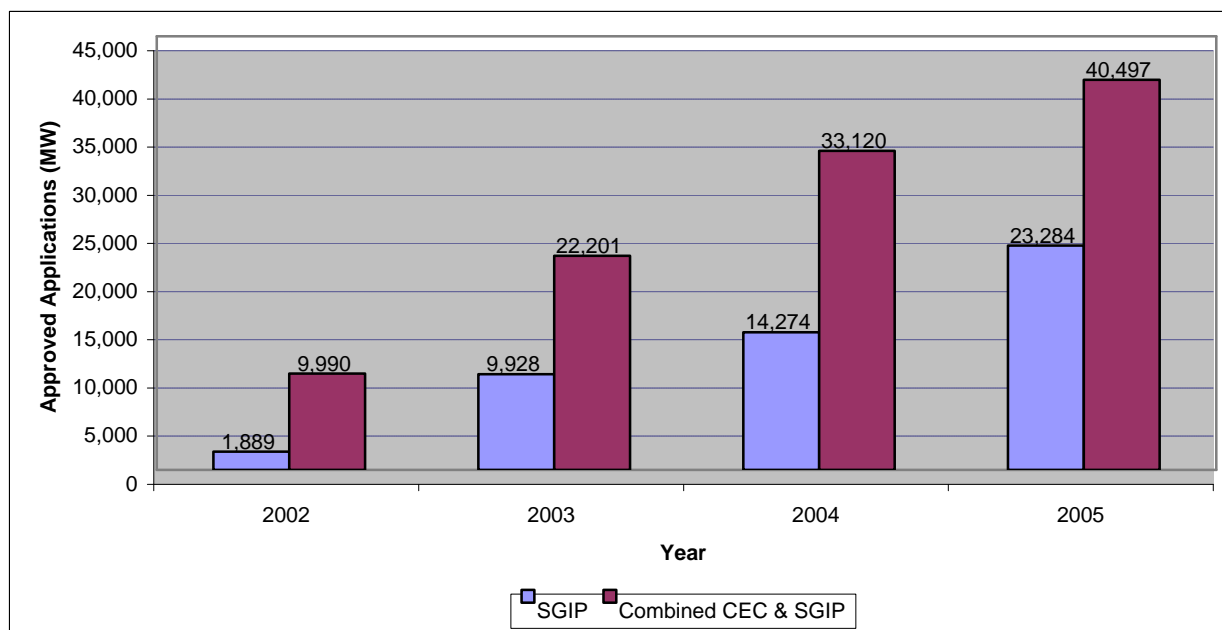
The first factor is that the SGIP program has limited funds and is designed to service very large PV projects, so it is possible for a handful of companies to flood the program with applications. The second factor is that there is no requirement for a signed contract prior to reserving a rebate. The third factor is that the rebate levels of the SGIP have been historically higher than the ERBP rebates. Combining these factors we have the following situation: with the financial advantages large projects have over smaller ones, SGIP projects, with the higher rebate, have been to displacing ERBP projects. For example, a salesperson who could offer a rebate of \$4.50/W for a 35 KW project rather than \$4/W for a 25 KW project would naturally choose the larger, more competitive option. This higher rebate has driven up demand up for the SGIP program. Once it became apparent to any company’s sales staff that all of the year’s rebates could be locked up for months by other companies, without those companies having to make a single actual sale, every company began to do the same to beat the other companies to the punch. This created a positive feedback loop which guaranteed the saturation of the program, and has resulted in the overenrollment and the extremely high dropout rate in the program.

This is not to say that actual demand for the SGIP program is not strong. It is strong, but only at the higher rebate levels and at the expense of the ERBP. The next graph (Fig. 4) from data

published by the CEC, shows the growth of the SGIP since 2002. The growth rate in the SGIP from 2003-2004 was 44%, and from 2004-2005 it was 63%. However, SGIP rebate levels were at \$4.50/W in 2003/2004, and \$3.50/W in 2005, much higher than today and over double what is currently contemplated by staff for 2007. Also, due to the long time lag between rebate reservation and installation, many of the 2005 installations were rebated at \$4.50/W from the previous year, and even today installations are scheduled for late 2006 which will receive the \$3.50/W rebate from the 2005 wait list. Therefore much of this apparent market growth is in fact deferred growth based on the suspension of SGIP program application acceptance and rebate levels far higher than what is available today.

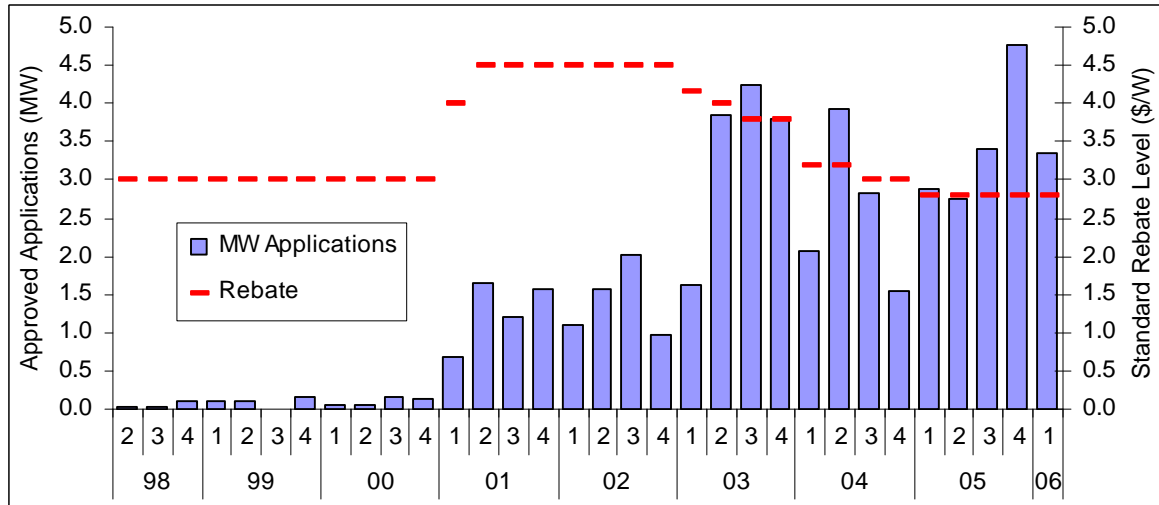
When combined with ERBP totals, overall PV growth rates drop to 49% and 22% respectively. This combined growth rate averages out to 35% per year, compounded, which meets the CSI need for at least 28% annual growth. However, our concern is that the industry is still working under the influence of the higher 2005 rebates, and even so growth slowed significantly in 2005. The proposal to further reduce rebates only portends further slowing of growth.

Figure 4: Combined SGIP and ERBP Installations – 2002 - 2005



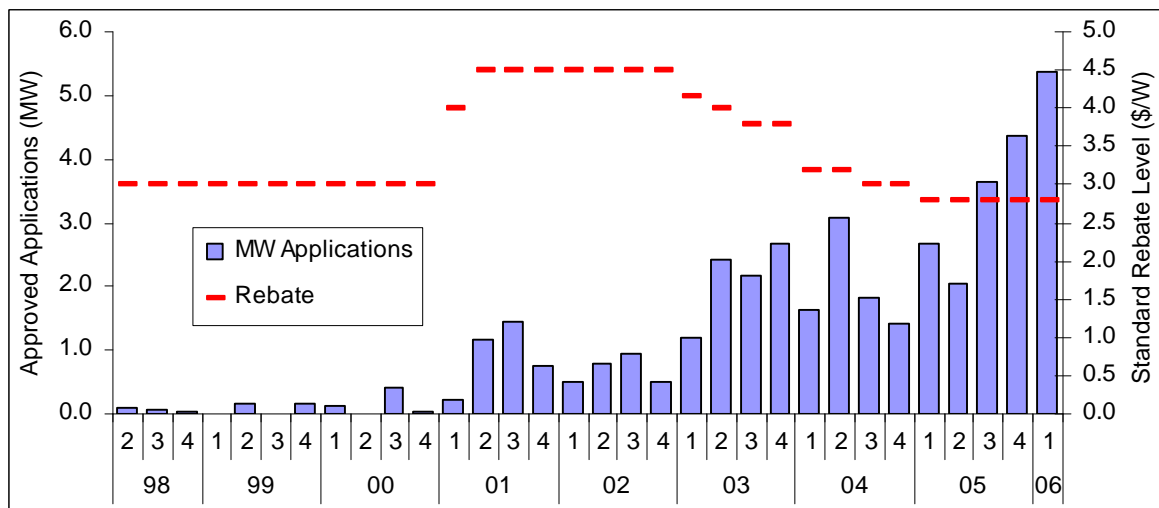
Residential growth rates have been flat since 2003, as shown in the following graph created by Ryan Wisner and his staff using data provided by the CEC. The figures are as follows: 2003: 13.5 MW; 2004: 10.4 MW; 2005: 13.8 MW.

Figure 5: ERBP Approved Applications < 6 KW 1998 – 2005



Commercial ERBP applications have been strong (see Fig. 6), rising at a 51% rate from 2003 through 2005. However, even this strong growth is only 23% per year, 5% less than needed to make the CSI successful.

Figure 6: ERBP Approved Applications > 6 KW 1998 - 2005



Conclusions based on the above:

- 1) The existing overall growth rate of the PV industry is strong, but is slower than what is needed for the CSI to be successful.
- 2) The residential growth rate is flat, and needs stronger incentives.
- 3) The commercial growth rate is strong, and needs to maintain its high rate of growth to meet CSI goals.
- 4) Due to the long time lags inherent in the rebate process, any drop in rebate levels will

send reverberations through the market that may take two years to be fully felt. Extreme care should be taken to fully evaluate the effect of a rebate change.

Market Incentivization

In order to understand how to properly incentivize the market, one must understand what motivates the customer to purchase a PV system. The motivation of a residential customer is completely different from a commercial or institutional customer. We will attempt to treat these three market segments below. Some of this analysis is based on the CalSEIA survey, but much of this analysis is my own, and is based on 30 years of practical selling experience in the residential and commercial solar markets, and with some experience in the municipal market. As such it would be fair to consider me an “expert” in the area of residential and commercial solar sales.

A) Residential Customers

Residential customers are by and large emotional in their decision making. They are strongly influenced by fear, and their decisions are heavily influenced by the current news headlines. Thus when there is a highly publicized rate increase, our phones start ringing. There is not a great love for the utilities, and getting “off the grid” is often mentioned as a strong motivator (though we must educate them about the pitfalls of that option). They easily agree that future utility rates will trend upward at a rate at least as fast as the past 30-years’ historical average. They are not generally technically oriented and except for the engineers and scientists they do not distinguish much among the various products, nor do they demand specific performance, though they do respond to the term “most efficient” (rather than “lowest cost per delivered watt”). The residential customer operates largely on trust, and will generally buy from the salesperson who they trust the most, with price often an important but secondary factor. As long as the system will eventually pay for itself and will retain resale value if they sell the home, they do not insist on a payback time of less than 10 to 15 years. They do not care about IRR or ROI calculations. The CalSEIA survey confirms this.

In my opinion we are at a market penetration level right now where we are still dealing with the “early adopters”. These are customers who are willing to take more risks and

who have a longer range view of the world. These early adopters are strongly motivated by the environmental consequences of their actions and are concerned about the legacy they will leave. Most of the current residential buyers are middle to upper class with significant disposable income. However, they respond strongly to the fact that the capacity incentive provides a quick up-front rebate rather than stretching the payments out over many years (especially with the potential complications of selling the home partway through the payout period). Long before the CSI ends we will be through the “early adopter” stage and we will need to satisfy the needs of the mainstream customer, who will have much greater sensitivity to price and much lower environmental motivation.

Based on the above analysis, I would draw the following conclusions:

- 1) In the early years craft the CSI such that the payback does not exceed 13 years, with a 10-12 year initial payback preferable.
- 2) In the later years craft the CSI with a shorter payback time to take into account the deeper market penetration required.
- 3) Do not attempt to impose a PBI plan with residential customers.
- 4) Use an annual inflation rate for electricity costs of 6.5%, which is the historical average for the past 30 years.

B) Commercial Customers

Though there are many categories of commercial customers, certain consistencies arise. Their decision-making is not emotional, but neither is it logical or consistent. Some look at IRR or ROI or NPV calculations, others look at payback. It is difficult to convince most commercial customers to treat a PV system much differently than a piece of equipment or a computer, which is not designed to last 30 years, because very few businesses have ever bought anything that will last 30 years (other than a building). They are skeptical of PV as a “new” technology. Therefore they often look for a 2 to 5 year payback, and with much effort can be convinced that a 6 to 8 year payback is reasonable. When looking at IRR, a 10% after-tax IRR is generally a bare minimum, with a 15-20% preferred. Due to the lower returns, those that do buy PV often cite their underlying environmental concerns, but also tie it to the beneficial marketing advantage that will accrue to the business from the investment. However, as time goes on and more systems are installed, this competitive advantage will disappear and must be replaced by even better economics.

Only the largest of businesses have ready access to large amounts of capital. Most business owners can only borrow a limited amount of money, and have already done so to run their operations. They consider capital a precious commodity, and need strong arguments to be convinced to part with it (or max out their borrowing) for an “optional” investment like PV when they might need that capital for an unexpected “necessary” expense.

When looking at the PBI program, a business investor will need significant extra incentives to consider a 5 year payment plan vs. up-front payment, for three reasons: first, since the PBI requires a higher up-front payment, the basis for the ROI calculation is increased accordingly. If an investor must invest 40% more in a PBI system, the savings (incentives plus energy savings plus tax savings) must be at least 40% higher to make the investment comparable. This means a 40% higher rebate is needed. Second, since time is money, the net present value of 5 years of payments, at an 8% discount rate, is only 80% of the sum of the payments, so the customer would need 25% more rebate to compensate. And third, any customer will have an inherent desire to have the money immediately, with certainty, rather than over 5 uncertain years, during which anything could happen.

Based on the above analysis, I would draw the following conclusions:

- 1) In the early years craft the CSI such that the payback does not exceed 8 years, with a 5-7 year payback preferable.
- 2) In the later years craft the CSI with a shorter payback time to take into account the loss of competitive advantage and the deeper market penetration required.
- 3) Any PBI plan, to be successful, must provide a stream of payments which will yield the same or better NPV as the up-front EBPP payment.
- 4) If the economics of the CSI program do not currently allow for the higher PBI payments, then provide all customers with the option of EPBB and let the market determine which is best.

C) Institutional/Municipal Customers

An institutional/municipal customer covers a wide range of entities and is not easily categorized. It could be a city, a county, a waste district, a school district, or any number of other entities. By and large their decisions are politically motivated. They do not spend their own money, and consequently they are not always price conscious. Since they have been around for many years

and will continue for many more, they have a long view and may not be concerned about payback term. They are used to paying too much for everything because of their cumbersome bidding processes, bonding requirements, inspection protocols, slowness in paying, and need for prevailing wage labor, among others. They often have access to large amounts of money at a low cost and thus may be a candidate for a direct purchase even though they have no use for tax advantages. They are the most likely to use Power Purchase Agreements, if it can be shown that the investor will be eligible for all of the tax advantages.

Based on the above analysis, I would draw the following conclusion:

- 1) For simplicity, design the CSI to match a commercial profile, on the assumption that a PPA will often be the owner of the system, and if not, the customer will not be sensitive to price.

Rebate Level Recommendations

Based on the above analysis and our CalSEIA survey, we recommend:

Residential: A maximum of a 13 year payback, with a preference for 10-12 years, reducing eventually even lower to assure eventual rebate phase-out. Our survey respondents indicate that if the payback goes from 13 to 15 years there will be a 29% reduction in sales, and if it goes to 17 years sales will drop off by 48%.

Commercial: A maximum of an 8 year payback, with a preference for 5-7 years, reducing eventually even lower to assure eventual rebate phase-out. Our survey respondents indicate that if the payback goes from 8 to 10 years there will be a 29% reduction in sales, and if it goes to 12 years sales will drop off by 48%.

Institutional/Municipal: Use the same rebate treatment as a commercial customer.

Most solar integrators have created their own financial tools to evaluate the IRR and payback for PV systems for their customers. We have modified our 30-year system evaluation tool to evaluate each of the 11 years of the CSI (including 2006, to provide a smooth transition) under varying conditions, for both residential and commercial customers. This is a proprietary tool and is not attached to this report. However, all relevant inputs and assumptions in the use of the tool are listed below, and the results are tabulated in Figures 8-11 and may be independently verified.

We used the tool to test the various models of rebate level adjustments against the ROI and payback requirements which we feel are needed to make the program successful. We included the schedule outlined in R.04-03-017, Appendix A, page 16, (see Fig. 7 below), as well as the schedule \$1.50/ \$2.25 declining by 10% Staff Proposal. We also tried some of our own

scenarios. The results are in Figs 8 – 11, showing 30-year cumulative annual savings for systems installed from 2006 through 2016. The payback period can be identified as the year that the savings go from negative to positive. The internal rate of return is shown at the bottom of each column.

Figure 7: PV Incentive Table using R.04-03-017

Year	Incremental MW	Proposed Rebate level	Total Incentive (\$ millions)
2006		\$2.80	
2007	50	\$2.50	125
2008	70	\$2.25	158
2009	100	\$2.00	200
2010	130	\$1.75	228
2011	170	\$1.50	255
2012	230	\$1.25	288
2013	300	\$1.00	300
2014	400	\$0.75	300
2015	500	\$0.50	250
2016	650	\$0.25	163
	2,600		2,265

In performing the above analyses, we made the following assumptions:

1. An initial Cost/CEC W of \$9.82 residential, and \$8.90 commercial, using the breakdown of costs per the CalSEIA survey.
2. Module cost reductions of 6% per year, starting in 2008
3. Inverter cost reductions of 3% per year throughout the 11 years.
4. Balance of system cost increases of 2% per year throughout the 11 years.
5. Labor cost increases of 3% per year throughout the 11 years.
6. Productivity increases of 2% per year throughout the 11 years.
7. The rebate schedule as outlined in R.04-03-017, Appendix A, page 16, with \$2.80/W throughout 2006
8. A 6.5% annual increase in the cost of electricity across the board, consistent with the CPUC's published electricity rates over the past 35 years (see Appendix, Table B).
9. Continuation of the Federal 30% tax credit (with \$2,000 residential limit) through 2017.
10. Degradation in system efficiency of 0.5% per year over the life of any system.
11. A State sales tax rate of 8.25%.
12. Initial annual energy savings of 1,625 KW per CECW.
13. Blended (multi-tier) initial utility costs of \$0.16/KWh residential and \$0.14/KWh commercial.
14. A 20% boost in residential customer savings under the E7 rate schedule; no such commercial savings.

15. Per Ryan Wiser, for commercial customers the rebate is considered taxable income; the basis for the federal tax credit is the full cost of the system and for depreciation it is 85% of the cost
16. The energy savings are treated as taxable income for commercial customers because they effectively reduce a deductible expense.
17. Federal tax rates of 38% commercial and 30% residential; state tax rates of 8.8% commercial and 7% residential

We have evaluated the following two systems:

Residential: 4,930 Peak W, 4,010 CEC W, system cost \$39,378

Commercial: 35,020 Peak W, 28,636 CEC W, system cost \$254,860

Figure 8: 30-Year Commercial PV System Savings Table using R.04-03-017

Rebate:	\$2.80	\$2.50	\$2.25	\$2.00	\$1.75	\$1.50	\$1.25	\$1.00	\$0.75	\$0.50	\$0.25
Cost/W:	\$8.90	\$8.91	\$8.58	\$8.27	\$7.98	\$7.71	\$7.46	\$7.23	\$7.01	\$6.80	\$6.62
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	(\$108,671)	(\$113,103)	(\$110,938)	(\$109,126)	(\$107,647)	(\$106,477)	(\$105,598)	(\$104,990)	(\$104,635)	(\$104,516)	(\$104,617)
2	(\$78,048)	(\$82,184)	(\$80,699)	(\$79,485)	(\$78,522)	(\$77,792)	(\$77,274)	(\$76,953)	(\$76,811)	(\$76,832)	(\$77,000)
3	(\$57,707)	(\$61,536)	(\$60,324)	(\$59,323)	(\$58,516)	(\$57,884)	(\$57,409)	(\$57,074)	(\$56,861)	(\$56,754)	(\$56,737)
4	(\$43,418)	(\$46,928)	(\$45,734)	(\$44,708)	(\$43,831)	(\$43,084)	(\$42,448)	(\$41,906)	(\$41,440)	(\$41,032)	(\$40,665)
5	(\$28,841)	(\$32,014)	(\$30,819)	(\$29,746)	(\$28,776)	(\$27,890)	(\$27,068)	(\$26,293)	(\$25,544)	(\$24,805)	(\$24,055)
6	(\$19,576)	(\$22,438)	(\$21,034)	(\$19,720)	(\$18,474)	(\$17,277)	(\$16,108)	(\$14,948)	(\$13,775)	(\$12,570)	(\$11,311)
7	(\$14,731)	(\$17,265)	(\$15,453)	(\$13,709)	(\$12,009)	(\$10,331)	(\$8,653)	(\$6,952)	(\$5,206)	(\$3,392)	(\$1,487)
8	(\$9,544)	(\$11,728)	(\$9,485)	(\$7,286)	(\$5,104)	(\$2,917)	(\$699)	\$1,575	\$3,928	\$6,387	\$8,977
9	(\$3,995)	(\$5,806)	(\$3,107)	(\$426)	\$2,265	\$4,993	\$7,783	\$10,663	\$13,660	\$16,803	\$20,120
10	\$1,937	\$525	\$3,705	\$6,897	\$10,128	\$13,427	\$16,823	\$20,347	\$24,027	\$27,895	\$31,983
11	\$8,274	\$7,287	\$10,979	\$14,711	\$18,513	\$22,418	\$26,457	\$30,661	\$35,066	\$39,703	\$44,608
12	\$15,043	\$14,508	\$18,740	\$23,044	\$27,452	\$31,998	\$36,718	\$41,645	\$46,816	\$52,269	\$58,041
13	\$22,267	\$22,215	\$27,019	\$31,928	\$36,977	\$42,204	\$47,644	\$53,337	\$59,322	\$65,639	\$72,330
14	\$29,974	\$30,436	\$35,846	\$41,396	\$47,124	\$53,071	\$59,276	\$65,780	\$72,627	\$79,861	\$87,526
15	\$38,194	\$39,203	\$45,253	\$51,482	\$57,930	\$64,640	\$71,655	\$79,019	\$86,780	\$94,985	\$103,683
16	\$46,956	\$48,548	\$55,277	\$62,224	\$69,434	\$76,952	\$84,825	\$93,101	\$101,831	\$111,065	\$120,859
17	\$56,293	\$58,505	\$65,952	\$73,660	\$81,677	\$90,052	\$98,835	\$108,077	\$117,833	\$128,159	\$139,114
18	\$66,239	\$69,110	\$77,318	\$85,833	\$94,705	\$103,987	\$113,733	\$124,000	\$134,844	\$146,328	\$158,513
19	\$76,832	\$80,404	\$89,417	\$98,785	\$108,563	\$118,806	\$129,574	\$140,925	\$152,924	\$165,634	\$179,123
20	\$88,108	\$92,426	\$102,291	\$112,564	\$123,301	\$134,563	\$146,413	\$158,915	\$172,135	\$186,146	\$201,019
21	\$100,109	\$105,220	\$115,988	\$127,218	\$138,972	\$151,314	\$164,310	\$178,030	\$192,547	\$207,936	\$224,275
22	\$112,879	\$118,833	\$130,557	\$142,801	\$155,631	\$169,117	\$183,328	\$198,340	\$214,230	\$231,080	\$248,973
23	\$126,463	\$133,313	\$146,049	\$159,367	\$173,338	\$188,035	\$203,534	\$219,915	\$237,261	\$255,659	\$275,200
24	\$140,909	\$148,711	\$162,519	\$176,975	\$192,155	\$208,135	\$224,999	\$242,831	\$261,720	\$281,759	\$303,046
25	\$156,270	\$165,083	\$180,027	\$195,688	\$212,147	\$229,488	\$247,798	\$267,167	\$287,691	\$309,470	\$332,608
26	\$172,599	\$182,487	\$198,633	\$215,571	\$233,386	\$252,169	\$272,010	\$293,009	\$315,266	\$338,888	\$363,989
27	\$189,956	\$200,984	\$218,403	\$236,694	\$255,946	\$276,255	\$297,721	\$320,446	\$344,540	\$370,116	\$397,297
28	\$208,400	\$220,640	\$239,408	\$259,131	\$279,905	\$301,833	\$325,018	\$349,573	\$375,614	\$403,262	\$432,646
29	\$227,996	\$241,523	\$261,720	\$282,960	\$305,347	\$328,989	\$353,998	\$380,492	\$408,596	\$438,439	\$470,160
30	\$248,814	\$263,708	\$285,417	\$308,265	\$332,361	\$357,819	\$384,760	\$413,309	\$443,599	\$475,770	\$509,967
IRR:	8.99%	8.85%	9.66%	10.44%	11.18%	11.91%	12.61%	13.29%	13.95%	14.61%	15.25%

Figure 9: 30-Year Commercial PV System Savings Table using Staff Proposal

Rebate:	\$2.50	\$1.50	\$1.35	\$1.22	\$1.09	\$0.98	\$0.89	\$0.80	\$0.72	\$0.65	\$0.58
Cost/W:	\$8.90	\$8.91	\$8.58	\$8.27	\$7.98	\$7.71	\$7.46	\$7.23	\$7.01	\$6.80	\$6.62
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	(\$113,241)	(\$128,338)	(\$124,649)	(\$121,085)	(\$117,648)	(\$114,336)	(\$111,148)	(\$108,080)	(\$105,131)	(\$102,297)	(\$99,572)
2	(\$82,618)	(\$97,418)	(\$94,410)	(\$91,444)	(\$88,524)	(\$85,650)	(\$82,824)	(\$80,043)	(\$77,307)	(\$74,612)	(\$71,956)
3	(\$62,277)	(\$76,771)	(\$74,035)	(\$71,282)	(\$68,518)	(\$65,743)	(\$62,959)	(\$60,164)	(\$57,357)	(\$54,534)	(\$51,692)
4	(\$47,988)	(\$62,162)	(\$59,445)	(\$56,667)	(\$53,832)	(\$50,942)	(\$47,997)	(\$44,996)	(\$41,936)	(\$38,812)	(\$35,621)
5	(\$33,412)	(\$47,248)	(\$44,530)	(\$41,705)	(\$38,778)	(\$35,749)	(\$32,618)	(\$29,383)	(\$26,040)	(\$22,585)	(\$19,011)
6	(\$24,190)	(\$37,816)	(\$34,874)	(\$31,791)	(\$28,569)	(\$25,210)	(\$21,710)	(\$18,067)	(\$14,275)	(\$10,329)	(\$6,219)
7	(\$19,387)	(\$32,785)	(\$29,422)	(\$25,893)	(\$22,198)	(\$18,337)	(\$14,306)	(\$10,100)	(\$5,711)	(\$1,131)	\$3,652
8	(\$14,243)	(\$27,392)	(\$23,583)	(\$19,582)	(\$15,388)	(\$10,997)	(\$6,405)	(\$1,603)	\$3,418	\$8,669	\$14,164
9	(\$8,737)	(\$21,613)	(\$17,334)	(\$12,834)	(\$8,112)	(\$3,162)	\$2,025	\$7,456	\$13,146	\$19,106	\$25,355
10	(\$2,849)	(\$15,426)	(\$10,650)	(\$5,624)	(\$343)	\$5,199	\$11,013	\$17,111	\$23,508	\$30,219	\$37,265
11	\$3,446	(\$8,806)	(\$3,505)	\$2,077	\$7,948	\$14,116	\$20,594	\$27,397	\$34,542	\$42,048	\$49,937
12	\$10,172	(\$1,728)	\$4,127	\$10,298	\$16,792	\$23,623	\$30,803	\$38,352	\$46,288	\$54,635	\$63,418
13	\$17,353	\$5,835	\$12,277	\$19,070	\$26,224	\$33,754	\$41,678	\$50,015	\$58,789	\$68,026	\$77,754
14	\$25,017	\$13,913	\$20,975	\$28,425	\$36,277	\$44,547	\$53,257	\$62,429	\$72,089	\$82,268	\$92,997
15	\$33,194	\$22,537	\$30,254	\$38,399	\$46,989	\$56,042	\$65,584	\$75,639	\$86,238	\$97,413	\$109,202
16	\$41,913	\$31,738	\$40,148	\$49,028	\$58,398	\$68,281	\$78,702	\$89,692	\$101,284	\$113,515	\$126,425
17	\$51,207	\$41,552	\$50,694	\$60,352	\$70,548	\$81,307	\$92,659	\$104,638	\$117,281	\$130,629	\$144,727
18	\$61,111	\$52,015	\$61,932	\$72,412	\$83,481	\$95,168	\$107,506	\$120,532	\$134,288	\$148,818	\$164,173
19	\$71,660	\$63,165	\$73,902	\$85,252	\$97,245	\$109,914	\$123,294	\$137,429	\$152,362	\$168,145	\$184,832
20	\$82,893	\$75,044	\$86,648	\$98,919	\$111,890	\$125,597	\$140,081	\$155,389	\$171,570	\$188,678	\$206,774
21	\$94,852	\$87,695	\$100,216	\$113,461	\$127,467	\$142,273	\$157,926	\$174,476	\$191,977	\$210,489	\$230,078
22	\$107,578	\$101,165	\$114,655	\$128,931	\$144,032	\$160,002	\$176,892	\$194,756	\$213,655	\$233,654	\$254,824
23	\$121,119	\$115,501	\$130,018	\$145,385	\$161,645	\$178,847	\$197,046	\$216,302	\$236,681	\$258,254	\$281,098
24	\$135,523	\$130,756	\$146,360	\$162,881	\$180,367	\$198,873	\$218,459	\$239,189	\$261,135	\$284,375	\$308,991
25	\$150,841	\$146,985	\$163,738	\$181,481	\$200,266	\$220,152	\$241,205	\$263,496	\$287,102	\$312,107	\$338,601
26	\$167,127	\$164,246	\$182,216	\$201,251	\$221,411	\$242,759	\$265,366	\$289,309	\$314,672	\$341,546	\$370,029
27	\$184,440	\$182,600	\$201,857	\$222,262	\$243,877	\$266,772	\$291,024	\$316,717	\$343,941	\$372,795	\$403,384
28	\$202,841	\$202,112	\$222,733	\$244,587	\$267,742	\$292,275	\$318,269	\$345,815	\$375,011	\$405,961	\$438,781
29	\$222,395	\$222,853	\$244,916	\$268,304	\$293,090	\$319,358	\$347,197	\$376,705	\$407,988	\$441,160	\$476,343
30	\$243,170	\$244,894	\$268,485	\$293,496	\$320,010	\$348,114	\$377,907	\$409,493	\$442,987	\$478,511	\$516,197
IRR:	8.06%	6.08%	7.16%	8.23%	9.32%	10.42%	11.54%	12.68%	13.85%	15.06%	16.32%

Figure 10: 30-Year Residential PV System Savings Table using R.04-03-017

Rebate:	\$2.80	\$2.50	\$2.25	\$2.00	\$1.75	\$1.50	\$1.25	\$1.00	\$0.75	\$0.50	\$0.25
Cost/W:	\$9.82	\$9.83	\$9.46	\$9.12	\$8.80	\$8.50	\$8.22	\$7.96	\$7.72	\$7.49	\$7.28
Year	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
1	(\$24,131)	(\$25,279)	(\$24,766)	(\$24,340)	(\$23,995)	(\$23,726)	(\$23,528)	(\$23,396)	(\$23,325)	(\$23,310)	(\$23,348)
2	(\$22,805)	(\$23,867)	(\$23,262)	(\$22,739)	(\$22,290)	(\$21,910)	(\$21,594)	(\$21,336)	(\$21,131)	(\$20,974)	(\$20,860)
3	(\$21,400)	(\$22,370)	(\$21,669)	(\$21,042)	(\$20,482)	(\$19,985)	(\$19,544)	(\$19,153)	(\$18,805)	(\$18,497)	(\$18,223)
4	(\$19,911)	(\$20,785)	(\$19,980)	(\$19,243)	(\$18,567)	(\$17,946)	(\$17,372)	(\$16,839)	(\$16,342)	(\$15,873)	(\$15,428)
5	(\$18,334)	(\$19,105)	(\$18,191)	(\$17,338)	(\$16,538)	(\$15,784)	(\$15,070)	(\$14,388)	(\$13,731)	(\$13,093)	(\$12,467)
6	(\$16,803)	(\$17,471)	(\$16,439)	(\$15,461)	(\$14,529)	(\$13,634)	(\$12,770)	(\$11,929)	(\$11,104)	(\$10,286)	(\$9,470)
7	(\$15,172)	(\$15,732)	(\$14,575)	(\$13,464)	(\$12,391)	(\$11,347)	(\$10,325)	(\$9,316)	(\$8,312)	(\$7,304)	(\$6,285)
8	(\$13,436)	(\$13,879)	(\$12,590)	(\$11,339)	(\$10,117)	(\$8,916)	(\$7,726)	(\$6,539)	(\$5,345)	(\$4,136)	(\$2,903)
9	(\$11,587)	(\$11,908)	(\$10,478)	(\$9,079)	(\$7,700)	(\$6,331)	(\$4,963)	(\$3,587)	(\$2,192)	(\$770)	\$690
10	(\$9,620)	(\$9,810)	(\$8,232)	(\$6,675)	(\$5,129)	(\$3,583)	(\$2,027)	(\$451)	\$1,156	\$2,805	\$4,506
11	(\$7,527)	(\$7,578)	(\$5,843)	(\$4,120)	(\$2,397)	(\$663)	\$1,092	\$2,881	\$4,713	\$6,602	\$8,558
12	(\$5,301)	(\$5,204)	(\$3,303)	(\$1,404)	\$507	\$2,439	\$4,406	\$6,419	\$8,491	\$10,634	\$12,860
13	(\$2,933)	(\$2,679)	(\$603)	\$1,484	\$3,592	\$5,735	\$7,926	\$10,178	\$12,503	\$14,915	\$17,428
14	(\$416)	\$4	\$2,267	\$4,551	\$6,870	\$9,237	\$11,665	\$14,168	\$16,762	\$19,459	\$22,276
15	\$2,260	\$2,857	\$5,317	\$7,811	\$10,352	\$12,955	\$15,635	\$18,406	\$21,283	\$24,283	\$27,422
16	\$5,103	\$5,889	\$8,558	\$11,273	\$14,050	\$16,904	\$19,850	\$22,904	\$26,083	\$29,404	\$32,883
17	\$8,125	\$9,110	\$12,000	\$14,951	\$17,978	\$21,097	\$24,325	\$27,679	\$31,178	\$34,838	\$38,679
18	\$11,336	\$12,532	\$15,657	\$18,857	\$22,148	\$25,548	\$29,075	\$32,748	\$36,584	\$40,605	\$44,829
19	\$14,747	\$16,168	\$19,541	\$23,004	\$26,575	\$30,274	\$34,118	\$38,127	\$42,322	\$46,724	\$51,355
20	\$18,369	\$20,029	\$23,665	\$27,407	\$31,275	\$35,289	\$39,469	\$43,836	\$48,411	\$53,217	\$58,278
21	\$22,216	\$24,129	\$28,043	\$32,082	\$36,264	\$40,613	\$45,148	\$49,893	\$54,871	\$60,106	\$65,623
22	\$26,302	\$28,483	\$32,692	\$37,044	\$41,560	\$46,262	\$51,175	\$56,321	\$61,725	\$67,414	\$73,415
23	\$30,639	\$33,105	\$37,626	\$42,310	\$47,179	\$52,257	\$57,569	\$63,140	\$68,997	\$75,167	\$81,680
24	\$35,243	\$38,012	\$42,864	\$47,900	\$53,143	\$58,619	\$64,354	\$70,375	\$76,711	\$83,391	\$90,446
25	\$40,131	\$43,220	\$48,423	\$53,831	\$59,470	\$65,368	\$71,551	\$78,050	\$84,893	\$92,114	\$99,745
26	\$45,319	\$48,748	\$54,322	\$60,125	\$66,184	\$72,528	\$79,187	\$86,191	\$93,572	\$101,366	\$109,606
27	\$50,825	\$54,615	\$60,582	\$66,803	\$73,307	\$80,124	\$87,286	\$94,826	\$102,778	\$111,178	\$120,065
28	\$56,668	\$60,841	\$67,224	\$73,888	\$80,863	\$88,182	\$95,877	\$103,984	\$112,541	\$121,584	\$131,155
29	\$62,867	\$67,447	\$74,271	\$81,404	\$88,879	\$96,728	\$104,989	\$113,698	\$122,895	\$132,620	\$142,917
30	\$69,446	\$74,455	\$81,747	\$89,378	\$97,381	\$105,794	\$114,653	\$124,000	\$133,875	\$144,322	\$155,388
IRR:	4.95%	5.18%	6.32%	7.41%	8.46%	9.47%	10.46%	11.42%	12.35%	13.28%	14.18%

Figure 11: 30-Year Residential PV System Savings Table using Staff Proposal

Rebate:	\$2.50	\$2.25	\$2.03	\$1.82	\$1.64	\$1.48	\$1.33	\$1.20	\$1.08	\$0.97	\$0.87
Cost/W:	\$9.82	\$9.83	\$9.46	\$9.12	\$8.80	\$8.50	\$8.22	\$7.96	\$7.72	\$7.49	\$7.28
Year	1	2	3	4	5	6	7	8	9	10	11
1	(\$25,334)	(\$26,281)	(\$25,668)	(\$25,052)	(\$24,435)	(\$23,822)	(\$23,213)	(\$22,611)	(\$22,017)	(\$21,431)	(\$20,855)
2	(\$24,008)	(\$24,869)	(\$24,164)	(\$23,450)	(\$22,730)	(\$22,005)	(\$21,279)	(\$20,551)	(\$19,823)	(\$19,095)	(\$18,367)
3	(\$22,603)	(\$23,373)	(\$22,571)	(\$21,753)	(\$20,923)	(\$20,081)	(\$19,229)	(\$18,368)	(\$17,498)	(\$16,618)	(\$15,730)
4	(\$21,114)	(\$21,787)	(\$20,882)	(\$19,955)	(\$19,007)	(\$18,041)	(\$17,056)	(\$16,054)	(\$15,034)	(\$13,994)	(\$12,935)
5	(\$19,537)	(\$20,107)	(\$19,093)	(\$18,049)	(\$16,978)	(\$15,880)	(\$14,755)	(\$13,603)	(\$12,423)	(\$11,214)	(\$9,974)
6	(\$18,012)	(\$18,479)	(\$17,346)	(\$16,176)	(\$14,971)	(\$13,730)	(\$12,454)	(\$11,140)	(\$9,789)	(\$8,398)	(\$6,964)
7	(\$16,387)	(\$16,744)	(\$15,486)	(\$14,183)	(\$12,835)	(\$11,444)	(\$10,007)	(\$8,523)	(\$6,991)	(\$5,407)	(\$3,768)
8	(\$14,657)	(\$14,897)	(\$13,506)	(\$12,062)	(\$10,564)	(\$9,013)	(\$7,406)	(\$5,742)	(\$4,017)	(\$2,229)	(\$372)
9	(\$12,814)	(\$12,930)	(\$11,399)	(\$9,805)	(\$8,149)	(\$6,428)	(\$4,642)	(\$2,786)	(\$858)	\$1,146	\$3,233
10	(\$10,853)	(\$10,837)	(\$9,157)	(\$7,405)	(\$5,580)	(\$3,681)	(\$1,704)	\$354	\$2,497	\$4,731	\$7,061
11	(\$8,766)	(\$8,610)	(\$6,773)	(\$4,853)	(\$2,850)	(\$761)	\$1,417	\$3,689	\$6,061	\$8,537	\$11,126
12	(\$6,546)	(\$6,241)	(\$4,237)	(\$2,140)	\$51	\$2,341	\$4,732	\$7,232	\$9,845	\$12,578	\$15,440
13	(\$4,184)	(\$3,722)	(\$1,541)	\$743	\$3,134	\$5,636	\$8,254	\$10,994	\$13,863	\$16,869	\$20,020
14	(\$1,673)	(\$1,043)	\$1,324	\$3,808	\$6,410	\$9,137	\$11,994	\$14,989	\$18,128	\$21,423	\$24,881
15	\$996	\$1,804	\$4,370	\$7,064	\$9,890	\$12,855	\$15,966	\$19,230	\$22,657	\$26,256	\$30,039
16	\$3,834	\$4,831	\$7,606	\$10,522	\$13,586	\$16,803	\$20,182	\$23,732	\$27,463	\$31,386	\$35,513
17	\$6,850	\$8,047	\$11,044	\$14,197	\$17,511	\$20,996	\$24,659	\$28,511	\$32,564	\$36,829	\$41,322
18	\$10,055	\$11,465	\$14,696	\$18,099	\$21,679	\$25,447	\$29,411	\$33,584	\$37,977	\$42,606	\$47,484
19	\$13,459	\$15,095	\$18,575	\$22,242	\$26,104	\$30,172	\$34,455	\$38,967	\$43,722	\$48,735	\$54,022
20	\$17,076	\$18,951	\$22,695	\$26,642	\$30,802	\$35,187	\$39,808	\$44,680	\$49,817	\$55,237	\$60,958
21	\$20,917	\$23,046	\$27,069	\$31,313	\$35,789	\$40,510	\$45,489	\$50,741	\$56,284	\$62,135	\$68,316
22	\$24,996	\$27,395	\$31,713	\$36,271	\$41,082	\$46,159	\$51,517	\$57,173	\$63,145	\$69,453	\$76,120
23	\$29,328	\$32,012	\$36,643	\$41,534	\$46,700	\$52,154	\$57,913	\$63,996	\$70,423	\$77,215	\$84,397
24	\$33,926	\$36,914	\$41,876	\$47,120	\$52,661	\$58,514	\$64,699	\$71,234	\$78,143	\$85,448	\$93,176
25	\$38,808	\$42,118	\$47,430	\$53,048	\$58,986	\$65,263	\$71,898	\$78,913	\$86,332	\$94,181	\$102,487
26	\$43,990	\$47,641	\$53,325	\$59,338	\$65,698	\$72,423	\$79,535	\$87,058	\$95,018	\$103,442	\$112,361
27	\$49,490	\$53,502	\$59,581	\$66,013	\$72,818	\$80,018	\$87,636	\$95,697	\$104,229	\$113,263	\$122,832
28	\$55,326	\$59,723	\$66,218	\$73,094	\$80,372	\$88,075	\$96,228	\$104,860	\$113,999	\$123,679	\$133,935
29	\$61,520	\$66,324	\$73,261	\$80,607	\$88,386	\$96,622	\$105,342	\$114,577	\$124,359	\$134,724	\$145,709
30	\$68,092	\$73,327	\$80,732	\$88,577	\$96,886	\$105,686	\$115,008	\$124,883	\$135,346	\$146,436	\$158,193
IRR:	4.28%	4.64%	5.83%	7.02%	8.21%	9.42%	10.64%	11.90%	13.19%	14.52%	15.91%

Our conclusions are:

Commercial:

- 1) None of the scenarios will incentivize the customers to the levels that we recommend, but the original proposal in R.04-03-017 came reasonably close to the best scenario we could develop to both satisfy the MW requirements and the spending limits of the program. As can be seen in Fig. 8, at \$2.80/W for all of 2006, the initial commercial payback period is a little over 8 years, which is at the outer limit of what our research indicates will be sufficient to sell commercial projects. Systems sold in 2016 will have a payback of 6+ years, which should allow the complete phase-out of incentives.
- 2) The Staff Proposal of \$1.50/W in 2007 (see Fig. 9) will result in an unacceptable 10 year

payback in 2007, stretching out to 11 years in 2008, and only returning to 8 years by 2012. In our opinion this scenario would result in massive reductions in commercial PV sales for so many years that the industry might not recover from it at all.

Residential

- 1) Rebates should be raised immediately if possible to bring 2006 residential payback down from 13 to 12 years and stimulate the stagnant residential market (see Fig. 10).
- 2) Recognizing the difficulty of raising rebate levels, the incentive levels of R.04-03-017, though initially too low, will serve well in the residential market over the long run, resulting in a steady drop to an 8-year payback by 2016. For simplicity we recommend no difference between residential and commercial rebate levels, since identical rebate levels (slightly higher than current levels in both cases) will result in paybacks for the two sectors which are acceptable to each market.

3. Program goals should reflect the realistic value of the power produced, and expected future improvements in both solar technology and energy efficiency should be anticipated in program funding levels.

The key objective of the program is “to bring on line or displace 3,000 MW of power” (see Decision, p 5), and the first stated goal is to “add clean energy to peak demand resources” (see Decision, p 4). As a result of the CSI it is expected that solar systems in California will become more effective and households will become more energy efficient. To the extent that PV systems are made more efficient it will effectively take fewer installed megawatts to displace the 3,000 MW of PV system capacity. We endorse the position taken by Tom Hoff in his May 11 paper titled :Expected Performance Based Buydown (EPBB) Incentive Structure: Rationale and Implications (see attached), and add the following:

Both the EPBB and PBI are designed to increase the overall efficiency of solar systems in the state. To the extent that they succeed, it will reduce the average installed KW size of a typical PV system, proportional to the efficiency improvement. In order to properly allocate program funding this effect should be taken into account in the assessment of the total “equivalent” MW installed under the program, and the MW goal should be adjusted.

For example, in the extreme case that every system installed in the state was a tracking system with a 40% higher KWh output per installed KW than a fixed system, the total KWh production of the state’s PV systems would be 40% higher than originally anticipated. Therefore, we would achieve our goal of “displacing” 3,000 MW with only 21.4 MW of installed trackers (3,000 x

(1/1.4)). But since we are using EPBB and PBI to calculate incentive payments, we will still exhaust all of the program funds because funds will be paid out based on the higher expected (or actual) performance. Thus, even though the program would have succeeded in its goal of displacing 3,000 MW, it would appear that it fell far short.

We believe that it is reasonable and achievable to expect that PBI and EPBB will bring about at least a 10% improvement in system efficiency in the PV market. Therefore we recommend that the program goals be reduced initially by 10% to account for this effect. Throughout the 10 years of the program, performance will be measured and monitored, and the program goal can be adjusted accordingly. The best metric for measuring CSI performance will be MWh produced rather than MW installed. The MWh can then be equated to a standard benchmark system performance and converted to equivalent MW installed.

It is a stated goal of the CSI to take measures to assure that energy efficiency is improved. A compounding effect occurs as homes and businesses become more energy efficient over the next 10 years. The benchmark PV system will become smaller in proportion to the extent that the efficiency improvements reduce electrical usage. If, for example, by 2016 the average home or business is 10% more energy efficient than today, then a 2.7 KW PV system will do the job that a 3 KW system is currently expected to do. In that case it only requires 2,700 MW to power 1 million solar roofs, rather than 3,000 MW. This effect is measurable, to the extent that average energy usage in California homes is regularly tracked and studied.

It is clear from our earlier analysis that program funding levels are marginal in incentivizing the market sufficiently to create the desired 30% annual growth in PV installation rates. If, however, the above efficiency effect is factored into the MW goals of the CSI, additional program funds will become available on a per KW basis to maintain the incentive levels that we believe will be needed to stimulate the desired market growth.

We think it is reasonable and conservative to expect another 10% improvement in efficiency in home and business energy usage during the next 10 years. We recommend that the CSI MW goal be initially reduced by 10% to account for this effect and the resulting funds be allocated to increase incentive levels by 10% overall. The table below illustrates how this might work:

Figure 12: PV Incentive Table Modified for 10% Lower MW Goal

Year	Incremental MW	Proposed Rebate level	Total Incentive (\$ millions)
2006		\$2.80	
2007	40	\$2.70	108
2008	56	\$2.45	137
2009	80	\$2.20	176
2010	104	\$1.95	203
2011	136	\$1.70	231
2012	184	\$1.45	267
2013	240	\$1.20	288
2014	320	\$0.95	304
2015	400	\$0.70	280
2016	520	\$0.45	234
	2,080		2,228

This figure should be compared with Figure 7. In this scenario, the MW goal is reduced by 20% from 2,600 MW to 2,080 MW, to account for both the building energy efficiency improvements and the PV system efficiency improvements. The 2007 rebate is reduced to \$2.70/W rather than \$2.50, and then rebates continue to drop by \$.25/W as before. Total program funds expended go from \$2,265M to \$2,228M. We feel that this rebate schedule will be sufficient to incentivize the market to achieve the desired program goals assuming that the federal tax credit is renewed.

4. Module costs are the main driver in the cost of a PV system. While the California market is large, California is still a small player in a world market, and we must be realistic about the potential for module cost reductions.

The CSI is a program designed to create immediate and sustained growth in PV purchases in the state, and as such should be designed primarily to incentivize the ultimate buyer rather than as a vehicle to attempt to drive down worldwide module prices. Module costs are set on a world market, and that cost is currently rising due to 1) increased demand in other states and countries, 2) a shortage of purified silicon feedstock, and 3) high rebates and incentives in other states and countries which drive up module costs everywhere. It is unrealistic to expect that California

incentive levels will have any significant effect on the cost of modules.

With this in mind, though we are eventually anticipating reductions in module prices, the total cost to install a PV system is also greatly affected by cost increases in labor, copper, aluminum, and other equipment. Of the total cost of a system, our survey indicates that modules account for about 45 to 50% of the net retail cost. So even if module costs are cut in half, the cost of a PV system will be reduced by no more than 25%, while certain other system costs will likely also be increasing. Our economic analyses (see Fig. 8-11) conclude that over the 10 years of the CSI, system costs will be reduced by between 24% and 34%. We would consider any analysis that assumes a greater drop than this to be overly optimistic rather than realistic.

5. While simplicity is a desired outcome in the administration of the program, the market realities are actually quite complex and require sophisticated models and close supervision to prevent undesirable and possibly disabling disruptions in the program.

It is not possible to know today what the technology and market conditions will be in 10 years, or even 1 year. A successful program will include real-time feedback, flexibility in setting incentive levels and triggers, and sensitivity to the ever-changing market conditions which influence businesses and the public to invest in solar technology. An ever-growing number of businesses will rely on the steadily increasing flow of projects that will be needed to make this program a success. Those businesses and those employees who enter the field of solar energy can easily and unfairly be put out of work if the program experiences avoidable funding shortages, rebate lapses, or incentive levels insufficient to attract buyers.

The CPUC should rely heavily on the market feedback which the industry will be happy to provide. In return, the companies that commit their resources to creating new business deserve to be kept well-informed and prepared in advance for any changes that may be made in the program. The recent abrupt change from \$2.80 to \$2.50/W was just such a change, which threw many projects into turmoil. We recommend that there always be at least a 30-day notice provided to the industry for any changes to incentive levels or other program changes.

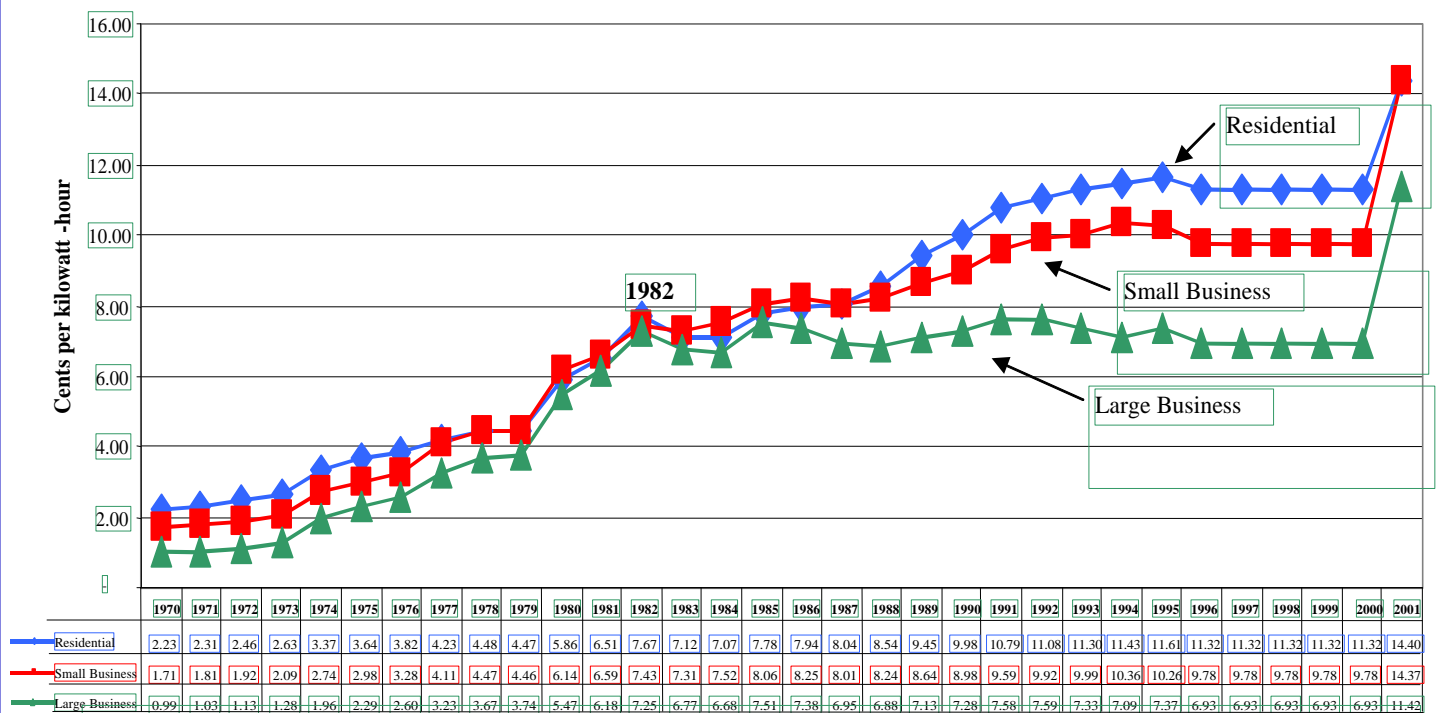
Appendix, Table A: State Incentives for Renewable Energy (from DSIRE website)

DATABASE OF STATE INCENTIVES FOR RENEWABLE ENERGY

[illegible]

Appendix, Table B: California Electricity Rates, 1970 – 2001 (CPUC)

California Electric Rates Residential, Small Business, and Large Business Sectors 1970 to 2001*



Source: Prepared by the CPUC Energy Division. Dataset from Energy Information Administration (EIA), DOE/EIA-0376(95), State Energy Price and Expenditure Report, 1995, Tables 36-38. 1996 through 2000 reflects AB 1890 frozen rates. 2001 rates include 4 cent increase in SCE and PG&E Rates.

*Rates only for SCE and PG&E.

